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APPENDIX D

Technical Scope of Work

Area of Investigation 1 - USOR Property

Remedial Investigation/Feasibility Study

US Oil Recovery Site

INTRODUCTION

This appendix to the Statement of Work (SOW) provides the preliminary technical scope of work for the Remedial Investigation/Feasibility Study (RI/FS) at Area of Investigation 1 ("AOI-1", also referred to as the "USOR Property" or "the property") at the US Oil Recovery Superfund site (the Site). The objective of the scope of work is to evaluate the nature and extent of contamination resulting from operations at the USOR Property, to obtain information necessary to fill data gaps in the Preliminary Conceptual Site Model (PCSM) for the USOR Property, and allow the development and evaluation of remedial action alternatives in the FS. The specific activities and procedures for implementing this RI/FS will be presented in subsequent work plans described in the SOW.

As described below, this scope of work is based upon the following analyses:

(1) Development of PCSMs for AOI-1 (human health and ecological), highlighting those potential exposure pathways and receptors for which additional data are needed to evaluate the completeness of a potential pathway and/or the significance of those pathways that are initially characterized as complete in support of the risk assessment.

(2) Design of an iterative RI characterization program and process that provides the needed data, including identification of media to be sampled, sample locations and associated analytical parameters.

(3) Identification of the data needed to complete the evaluation of potentially complete or potentially significant pathways in the PCSMs, and facilitate evaluation of potential remedial action alternatives in the FS.

Consistent with EPA's expectations as noted in Paragraph 2 of the SOW, an "iterative" approach to data collection will be used during the RI to maximize the overall investigative effectiveness and efficiency and assist in decision making. Also, consistent with the SOW and the Triad Approach, a streamlined data assessment and reporting process is proposed for the RI/FS. The iterative sampling program will start with the investigation of on-property (defined as the area inside the existing fence at the USOR Property) soil, groundwater, surface water and sediment and off-property (defined as the area outside of the existing fence at the USOR Property) soil and groundwater and proceed to off-property sediment, surface water, and other environmental media as appropriate. This iterative program will use the data collected in previous phase(s) of investigation to help focus COPCs and investigation areas for subsequent sampling efforts. It is believed that this approach will help minimize the likelihood of making erroneous decisions with data that are difficult to interpret, do not support the performance or acceptance criteria defined in the RI/FS Work Plan, or do not support the overall project goal of identifying potential risks associated with past AOI-1 activities.

PRELIMINARY CONCEPTUAL SITE MODELS

PCSMs are presented for human health and ecological pathways as Figures 1 and 2, respectively. PCSMs present the current understanding of the type and occurrence of potential contaminant sources and possible exposure pathways associated with AOI-1. Consistent with EPA RI/FS Guidance (EPA, 1988), the PCSMs were developed on the basis of existing AOI-1 conditions (i.e., land use, historical process knowledge, hydrogeology, source areas, COPCs, and existing data). The hypotheses presented in the PCSMs will be tested iteratively, refined, and modified as necessary as data are collected during the RI. The following subsections discuss AOI-1 conditions and available information that are important to understanding the overall PCSMs and remaining data needs.

Current Land Use

The USOR Property is located at 400 North Richey Street in Pasadena, Harris County, Texas, 77506 (Figure 3). The approximately 12.2 acre property was most recently used as a used oil processing and waste treatment facility by US Oil Recovery LLP. US Oil Recovery LLP began operations on the property in approximately June 2003 and acquired the property in December 2003. Prior to 2004, multiple businesses operated on the property including chemical manufacturing companies (specializing in fertilizers and/or herbicides/pesticides), a cow hide exporter, leather tanner, and companies with unknown operations including storage of various hard goods. Attachment D-1 contains a more detailed listing of the operational history of the property.

The USOR Property was abandoned by its current owner and is now under the custody and control of a court-appointed receiver. An office building, security guard shack, and large warehouse (approximately 25,000 square feet in size) are present on the property. The warehouse includes a former laboratory, machine shop, parts warehouse, and a material processing area that included a filter press. Approximately 800 55-gallon drums (some in over-packs) and 212 poly totes (300-400 gallons) containing various industrial wastes are present within the warehouse. A tank farm with approximately 24 aboveground storage tanks (ASTs) containing industrial wastes located within secondary containment is located on the north end of the warehouse. A large, concrete-walled aeration basin (also called the bioreactor) is located west of the tank farm. A containment pond is located west of the warehouse and south of the aeration basin. Approximately 225 roll-off boxes fitted with precipitation covers are located on the property. An inactive rail spur enters the south-central part of the USOR Property from the south and extends north along the west side of the warehouse. A utility right-of-way with various pipelines is present within the southern part of the property and pipelines are also present outside of the property along the eastern and western sides.

Currently, the USOR Property is abandoned, enclosed within a six-foot chain link security fence with locked gates, security cameras have been installed, and access is monitored by a security contractor and a site manager/inspector. The USOR Property was developed for industrial purposes in approximately 1947 and land use has remained industrial since that time. Land use in the vicinity of the USOR Property includes the following:

North: Undeveloped land that includes high-tension power lines, with Vince Bayou and a heavy industrial property located further north.
East: Undeveloped land that includes high-tension power lines, with N. Richey Street, Vince Bayou, and a heavy industrial property located further east.
South: An east-west oriented pipeline right-of-way is located along the southern boundary of the USOR Property with an east-west oriented railroad line, an additional east-west oriented pipeline right-of-way, and a heavy industrial property located further south.
West: A north-south pipeline right-of-way with undeveloped land, a City of Pasadena stormwater detention basin, and a heavy industrial property located further west.

Vince Bayou is located to the north and east of the USOR Property, is joined by Little Vince Bayou to the east of the USOR Property, and flows to the north and intersects with the east flowing Houston Ship Channel (HSC) approximately 0.4 miles north of the USOR Property. The closest residential land use is located approximately 0.08 miles (400 feet) south-southwest of the southwest corner of the USOR Property. The nearest public park (Light Company Park) is located approximately 0.24 miles (1,300 feet) south of the southern property boundary. The nearest school (Pasadena High School) is located approximately 0.5 miles southeast of the southern property boundary. The PCSMs are based on the premise that the USOR Property land use will remain commercial/industrial in the future. Documentation

of future use restrictions as an industrial/commercial property will be provided in the RI/FS Work Plan.

Topography

According to the Pasadena, Texas topographic map (USGS, 1982), the maximum elevation of AOI-1 is approximately 20 feet above mean sea level (msl) near the Containment Pond. The topography of the natural land surface generally slopes to the east and northeast towards Vince Bayou where the elevation is approximately sea level.

Geology

Based on the Geologic Atlas of Texas – Houston Sheet (BEG, 1982), subsurface soils at the USOR Property are underlain by the Beaumont Formation, which is comprised mostly of clay, silt, and sand and includes mainly stream channel, point-bar, natural levee, backswamp, and to a lesser extent coastal marsh and mud-flat deposits. The Beaumont Formation beneath the USOR Property is dominantly clay and mud of low permeability, high water-holding capacity, high compressibility, high to very high shrink-swell potential, poor drainage, level to depressed relief, low shear strength, and high plasticity.

Hydrogeology

The Gulf Coast Aquifer is a major aquifer underlying AOI-1 that consists of the Evangeline, Chicot and Jasper aquifers, which are composed of discontinuous sand, silt, clay, and gravel beds (TWDB, Report 380, July 2011). The apparent direction of groundwater flow in these units is to the southeast toward the Gulf of Mexico. In addition to the primary aquifers, groundwater often occurs in sand units in the shallow subsurface within the Beaumont Formation. These water-bearing units are not typically used for irrigation or drinking water due to relatively low yields or poor quality.

Limited previous subsurface investigations at the USOR Property have encountered silty clay, clay, silt and sand to a depth of approximately 25 feet below ground surface (bgs). Groundwater was observed at approximately 10 to 12 feet bgs during previous investigations. The apparent direction of groundwater flow at the USOR Property is to the northeast toward Vince Bayou.

Potential Source Areas and Chemicals of Potential Concern (COPCs)

The following potential source areas are present at AOI-1:

1) Drums
2) Aeration Basin (Bioreactor)
3) Sumps
4) Totes
5) Containment Pond
6) Aboveground Storage Tanks
7) Roll-off Boxes/Frac Tanks
8) Impacted Soil (including the former buried waste pit to the west of the warehouse that was identified in historical documents)
9) Unknown Subsurface Sources (Pits, Sumps, etc.)
10) Pipelines

Removal actions to address potential source areas 1-~~6~~ 7 listed above are being developed/implemented and are planned to be completed before initiation of the RI sampling program. Attachment D-1 provides for AOI-1: 1) general information, 2) ownership and operational history, 3) a list of historical releases

taken from existing documents, 4) investigation history, 5) a list of historical removal and response actions, 6) potential impacts at off-property areas, and the rationale for sample locations at AOI-1 that are provided below in this document. Removal actions conducted by the PRP Group will be documented in separate reports to EPA and TCEQ. It should be noted that additional removal or remedial actions may be necessary pending the outcome of the RI but, at this time, those actions have not been identified.

A preliminary list of COPCs has been developed based on historical data for hazardous substances present at the USOR Property, waste materials previously handled or currently present at the USOR Property, and analytical laboratory results of samples of environmental media collected from the USOR Property and nearby off-property areas. Samples were collected by EPA and TCEQ (or their contractors) during release response actions prior to July 2010 or stabilization activities conducted after the property was abandoned in July 2010. Prior to July 2010, samples were collected during release-related response actions including samples of liquids leaking from containment vessels, ponded liquids, and/or impacted soil. After July 2010, liquid, sludge and solid samples were collected from drums, the bioreactor, sumps, poly totes, above-ground storage tanks, the containment pond, and roll-off boxes. Samples were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, and metals, and Total Petroleum Hydrocarbons (TPH). As summarized in the Hazard Ranking System (HRS) Documentation Record (EPA, 2011), VOCs, SVOCs, pesticides, metals, and TPH were detected in the samples and are attributed to the USOR Property. A review of past industrial operations at the USOR Property and the results of previous environmental investigations conducted at the USOR Property support the inclusion of VOCs, SVOCs, pesticides, herbicides, and metals on the initial list of COPCs for the RI. For example, metals (arsenic), pesticides and herbicides are included due to historic use of the property for the manufacture of arsenical pesticide products, and the blending and storage of pesticides and herbicides. The COPC list will be refined after each iteration of the RI/FS as USOR Property data are evaluated such that only those COPCs that originated at the USOR Property are moved forward, as described more fully below.

Possible Exposure Pathways

The human health and ecological PCSMs for the USOR Property (Figures 1 and 2) show the range of human health and ecological exposure pathways including the primary and secondary sources, the primary and secondary release mechanisms, the exposure media (i.e., soil, groundwater, surface water, sediment, air, etc.), and potential receptors. The processes or mechanisms by which receptors may reasonably come into contact with USOR Property-related COPCs are shown from left to right on the figure. Exposure pathways are dependent on current and future land use, which is expected to remain as an industrial land use. An exposure pathway is defined by four elements (U.S. EPA, 1989):

- A source material and mechanism of constituent release to the environment;
- An environmental migration or transport media (e.g., soil) for the released constituents;
- A point of contact with the media of interest; and
- An exposure route (e.g., ingestion) at the point of contact.

An exposure pathway is considered “complete” if all four elements are present.

Potentially complete human health exposure pathways are indicated with a “C” in the potential receptors column of Figure 1. Potentially complete pathways are assumed to be complete based on existing information. Although a pathway may be preliminarily identified as potentially complete, additional data are often needed to confirm that the pathway is complete and evaluate the significance of the potentially complete pathway. The PCSM also identifies possibly complete pathways with a “P” in the potential receptors column of Figure 1. At this stage of the RI/FS, it is not known whether these media have been impacted by USOR Property-related activities. Information related to complete and potentially and

possibly complete exposure pathways will be used to identify data gaps and help guide the data collection effort, ultimately ensuring that sufficient data are collected to facilitate quantitative evaluation of these pathways in the human health risk assessment. Pathways that are not viable are considered incomplete and are identified with an "I" in the potential receptors column on Figure 1, most often because the receptor will not contact the media specified.

Potentially complete ecological exposure pathways are indicated with a "C" in the potential receptors column of Figure 2. Potentially complete pathways are assumed to be complete based on existing information. Although a pathway may be preliminarily identified as potentially complete, additional data are often needed to confirm that the pathway is complete and evaluate the significance of the potentially complete pathway. The ecological PCSM also identifies potentially complete pathways for which potential exposures will be evaluated in an iterative manner with a "P" in the potential receptors column of Figure 2. At this stage of the RI/FS, it is not known whether these media have been impacted by USOR Property-related activities. Information related to complete and potentially complete exposure pathways will be used to identify data gaps and help guide the data collection effort, ultimately ensuring that sufficient data are collected to facilitate quantitative evaluation in the ecological risk assessment. Pathways that are not viable are considered incomplete and are identified with an "I" in the potential receptors column on Figure 2, most often because the receptor will not contact the media specified.

In the first iteration of data collection, data will be collected for the on-property media (i.e, soil, groundwater, surface water, and sediment) and off-property soil and groundwater using the initial list of COPCs. The results of the evaluation of the first iteration data will then be used to develop an investigative strategy for off-property sediment and surface water based on those compounds that were determined to have originated at the USOR Property. The specific mechanism/criteria for that determination will be developed in the RI/FS Work Plan. The second iteration of data collection will include sampling of surface water and sediment in drainage paths leading to Vince Bayou and from within Vince Bayou (and possibly Little Vince Bayou), with sample locations/collection details and analyte list developed based on data from the previous investigation iterations. Finally, based on the evaluation of all previously collected data, sampling of fish and/or shellfish in Vince Bayou (and possibly Little Vince Bayou) will be conducted during a third iteration, as necessary. It is envisioned that a streamlined data evaluation and reporting process will be used to move from iteration to iteration in the RI as efficiently as possible (see details in the RI/FS Data Collection Activities section below). After each data collection iteration during the RI, the PCSMs presented in Figures 1 and 2 will be updated and refined as necessary. The iterative approach to the investigation and the streamlined data evaluation and reporting process are described in greater detail in the following sections.

DATA NEEDS

Based on an evaluation of the exposure pathways identified in Figures 1 and 2, and an analysis of the information needed to assess the completeness of these pathways, the data needs listed in Table 1 were developed for the USOR Property. Table 1 illustrates the data needs development process by: (1) noting the PCSM exposure medium for exposure pathways that were not judged to be incomplete; (2) identifying the specific data needed to determine whether that pathway is potentially complete; (3) listing the existing data that were reviewed as part of RI/FS scoping; and (4) describing the RI activities, approaches, and data collection methods to be performed to fill the identified data need.

A list of general data needs is also included in Table 1 and includes supplemental information needed for the RI such as land use, quality of habitat, climate, subsurface migration pathways, etc.

FS data needs are not included in Table 1 at this time. As FS data needs are identified as the iterative RI/FS process proceeds, appropriate programs to fill these needs will be developed. The development

and evaluation of remedial alternatives will be performed as specified in the RI/FS guidance. First, the risk assessment findings will be used to develop remedial action objectives. General response actions will be developed to address these objectives, and preliminary technologies/alternatives associated with those response actions will be screened. If at any time during this process a data need related to the FS is identified, a program to collect that data will be developed and implemented.

EXISTING DATA EVALUATION

As noted above, existing data were reviewed and used during development of the PCSMs and the data needs summary (Table 1).

Existing soil and groundwater data from the USOR Property were compiled into the tables listed below and attached to this Scope of Work. The soil data tables also contain any data from off-property areas that were investigated as a result of past releases from the USOR Property. Surface water and sediment data collected for EPA in 2011 (Weston Solutions, Inc., 2011) from Vince Bayou and Little Vince Bayou were also compiled since these data have been used by EPA to rank the Site using the HRS. All of the existing data are used for scoping purposes only and are not intended for use in risk assessment calculations or as the sole basis for evaluation of potential remedial alternatives in the FS. Sampling locations for the existing data shown in the tables are shown on Figures 4 and 5.

It should be noted that there are limited historic data for soil and groundwater at the USOR Property. Furthermore, much of the soil and groundwater data from historical documentation for the USOR Property are of limited value due to the fact that much of the data lack the required backup information such as sample location maps, quality assurance/quality control (QA/QC) data, and/or analytical method information. Also, the use of older data is limited due to changes in analytical methods, QA/QC procedures, etc. As such, some data from previous investigations at the USOR Property were not included in the summary tables for these and other reasons. Finally, laboratory qualifiers (flags) were not included for all data. Due to the range of different qualifiers used in the data packages, a consistent set of qualifiers was developed and used for the data summary tables.

The following data summary tables were compiled for AOI-1:

Table 2 - Metals Concentrations in Soil Samples
Table 3 – Volatile and Semi-Volatile Organic Compound Concentrations in Soil Samples
Table 4 – Pesticide Concentrations in Soil Samples
Table 5 – Metals and Pesticides Concentrations in Groundwater Samples
Table 6 – Metals Concentrations in Surface Water Samples – 2011 Data
Table 7 – Metals Concentrations in Sediment – 2011 Data
Table 8 – Volatile and Semi-Volatile Organic Compound Concentrations in Sediment – 2011 Data

DATA QUALITY OBJECTIVES

Data quality objectives (DQOs) (Table 9) are developed as part of the systematic planning process to define the type and quality of the data sufficient to characterize the USOR Property, conduct human health and ecological risk assessments, and perform the evaluation of remedial alternatives. The DQOs, therefore, support the rationale for the USOR Property investigation strategy and approach detailed in the following section. The data quality details of the DQO process will also be documented in the Quality Assurance Project Plan (QAPP) that will be developed with the RI/FS Work Plan.

The DQOs have been developed in general accordance with the "Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA QA/G-4" (EPA, 2006). When data are collected during the

RI/FS, the EPA-recommended systematic planning tool is the DQO process. The DQO process is a seven-step planning approach to develop sampling designs for data collection activities that support decision-making. The seven steps of the DQO process described by EPA are:

1. State the problem.
2. Identify the goal of the study.
3. Identify information inputs.
4. Define the boundaries of the study.
5. Develop the analytic approach.
6. Specify performance or acceptance criteria.
7. Develop the plan for obtaining data.

Steps 1 through 4 of the process are included in Table 9 and are discussed below. Steps 5 through 7 will be developed in the RI/FS Work Plan and QAPP since these steps are focused on detailed sampling and analytical processes and are not appropriate for this document. Some of the more important issues related to the DQOs are described in the following paragraphs.

Step 1: State the Problem

Historical USOR Property information suggests that contamination exists in on-property soil in areas of former operations, and that ~~contaminants~~ COPCs may have migrated off-property during unauthorized releases, spills and overland runoff following storm events. Previous sampling efforts, historical aerial photographs, relevant USOR Property information and reports have been thoroughly reviewed to better understand where ~~contamination~~ COPCs may be on-property, what COPCs are potentially present, and what fate and transport of these COPCs may have occurred.

Because of the gradual topographic slope at the USOR Property, if COPCs were transported from the property, they would most migrate from the USOR Property to the east or north, deposit onto the surface soils in these areas and either remain in those soils or be transported further down-slope. Vince Bayou surface water and sediment would be the potential endpoint of transport and migration of USOR Property-related COPCs. Due to the highly industrialized nature of the surrounding area and the numerous possible point and non-point sources of ~~contaminants~~ COPCs in Vince Bayou and Little Vince Bayou unrelated to the USOR Property, it is difficult to identify the USOR Property-related COPCs without a thorough and complete understanding of on-property source characteristics and the transport/migration pathways off-property.

Develop the PCSM for the Area of Investigation

The PCSMs introduced above (Figures 1 and 2) convey what is known about the sources, releases, release mechanisms, contaminant fate and transport, exposure pathways, potential receptors and risks. The PCSMs were developed based on the review of relevant USOR Property information and with input from the PRP Group and EPA. Data collected during the RI/FS will be used to verify and revise the models as necessary. These DQOs were developed using the PCSMs.

Establish the Planning Team

The planning team is composed of project management and technical staff from EPA, TCEQ, identified Federal and State Natural Resource Trustees (Trustees), the PRP Group, and Pastor, Behling & Wheeler, LLC (PBW). The Project Team and organization will be described in the RI/FS Work Plan. The project management section of the RI/FS Work Plan will describe the decision-level authority and communication. Project management team members have been designated as members of the project

decision-making team and as technical expertise support. Lines of communication are established between field staff, project management, the PRP Group, EPA, and other agency stakeholders to convey data from the field to decision makers and to convey decisions back to the field staff.

Identify Available Resources, Constraints and Deadlines

During the systematic planning, several critical field activities were identified. The outcome of these critical field activities may impact the scope and extent of other USOR Property investigation tasks. The critical field activities are the on-property surface and subsurface soil sampling, on-property sediment and surface water sampling, installation of monitoring wells on-property, and groundwater sampling from these monitoring wells. Based on the data obtained from the on-property field work, additional field activities will be undertaken in subsequent iterations. These subsequent iterations are anticipated to include the installation of additional monitoring wells on-property or off-property, groundwater sampling of these monitoring wells, off-property surface and/or subsurface soil sampling, and collection of background soil samples. Data obtained from these additional on-property and/or off-property sampling efforts will be used to focus subsequent off-property sediment and surface water (near the USOR Property and background), and potential fish and/or biota sampling investigation iterations.

Other practical constraints such as access and physical location that will affect characterization activities will need to be addressed. The presence of pipelines, utility easements and other AOI-1 features will be evaluated and sampling locations may change from the locations identified in this Scope of Work if necessary. The overall deliverable for the investigative activities at the USOR Property will be the RI/FS Report. However, several data assessment meetings (working meetings) will be held with EPA, ~~and~~ TCEQ and Trustees stakeholders to review the RI data as it is collected and prior to conducting the next iteration of sampling, and develop work plan refinements as needed.

The available resources include the project management, technical staff, and drilling, and environmental laboratory contractors. Scheduling constraints of these personnel are not anticipated at this time. USOR Property characterization will be conducted in accordance with the Scope of Work provided herein and described in greater detail in the RI/FS Work Plan.

Step 2. Identify the Goal of the Study

The over-arching goals for the project are to characterize nature and extent of contamination associated with past USOR Property-related activities, demonstrate whether a COPC originated from the USOR Property, estimate potential human health and ecological risks from USOR Property-related COPCs, and design an effective remedial action plan for USOR Property-related impacts.

The review of historical data for the USOR Property was used in conjunction with the PCSMs to develop the data needs table shown in Table 1. This table was used to tie the potentially complete exposure pathways to the media of concern so that relevant USOR Property data could be collected to support the goals of the study.

At this point in the DQO process, the principal study questions, actions and decision statements are developed in a detailed manner for each media to be investigated. The result of these and subsequent steps of the DQO development process are presented in Table 9.

RI/FS DATA COLLECTION ACTIVITIES

The PCSMs, the conceptual descriptions of RI/FS activities in Table 1, and the DQOs were used to develop the initial RI/FS data collection activities and sample locations described below. Historical

information (e.g., maps, aerial photographs, reports and other documentation) regarding potential source areas, property reconnaissance, and to a lesser degree the limited existing data, were used to guide the placement of initial investigation locations. Attachment D-1 provides a more detailed discussion of the rationale for each sample location for on-property media as well as off-property soil sample locations. These samples were selected in order to optimize the likelihood of detecting potential impacts from the USOR Property. Relative to a grid-based sampling program, these judgmental samples will likely overestimate potential risk but this type of sampling will provide a higher degree of confidence in evaluating whether the COPC originated at the USOR Property. The RI/FS Work Plan and RI Report will include information related to the sampling scheme and the adequacy of spatial coverage to satisfy project goals. The number of samples and sample locations ultimately needed to satisfy overall RI/FS objectives will be determined by the USOR Property conditions and the data obtained during the iterative phases of the RI/FS. However, consistent with the overarching objective of this scope of work, sample numbers/locations are proposed herein for the initial investigation phase (i.e., on-property soil, groundwater, surface water and sediment sampling and off-property soil and groundwater) to fill the identified data needs.

As noted previously and as illustrated by the PCSMs, data needs summary table (Table 1), and DQOs, investigation activities will initially focus on on-property environmental media (i.e., on-property soil, on-property groundwater, on-property surface water and on-property sediment) and off-property soil and groundwater. An iterative approach is proposed as the logical and effective and time-efficient manner for which the RI should be performed. This is due to the nature of the USOR Property where the source areas are located topographically higher than some of the potential receptors and potential impacts are primarily related to the movement of COPCs from the USOR Property to the receptors via surface drainage. Furthermore, receptors in Vince Bayou and Little Vince Bayou also are potentially impacted from the other documented industrial activities within the Vince Bayou and Little Vince Bayou watershed. In this regard, the determination of the impacts from the USOR Property, versus those from other sources of contaminants to Vince Bayou and Little Vince Bayou, must be carefully executed through the iterative progression of investigation activities beginning on the USOR Property and adjacent properties and working to Vince Bayou and including a comprehensive background study for media of potential concern. This method will allow for the allocation of the relative contributions of COPCs to Vince Bayou and Little Vince Bayou among the multiple potential sources.

A data assessment meeting will be held after completing the data collection for each iteration to review the data, prior to proceeding with the next iteration of sampling. The iterative data collection program is described more fully below:

ITERATION	DESCRIPTION
1	AOI-1 on-property media (soil, groundwater, and surface water/sediment in the low-lying areas on the southwestern portion of AOI-1) and off-property soil and groundwater will be sampled and analyzed for the initial list of COPCs (metals, VOCs, SVOCs, pesticides, herbicides, and TPH) per the RI/FS Work Plan Sampling and Analysis Plan (SAP) and QAPP. After data validation, the sample concentrations will be compared to the screening criteria for that medium to be developed in the RI/FS Work Plan to determine whether the compound originated at the USOR Property. Data assessment tools (summary tables, maps, GIS data visualization, etc.) will be used to assist in making this determination. A working "data assessment" meeting will be held with the EPA, TCEQ and Trustees stakeholders ~~and agency stakeholders~~ where the data are reviewed and decisions are made regarding: 1) COPCs that will be carried forward and COPCs that can be eliminated from subsequent iterations of the RI/FS; and 2) locations of off-property surface water and sediment samples for the second iteration of

	the RI/FS. A Work Plan Refinement Notice (WRN) with the agreed-upon recommendations for the next iteration of sampling will be prepared for EPA approval. Upon receiving EPA approval, the specific activities proposed in the WRN will be initiated.
2	AOI-1 off-property surface water and sediment will be sampled and analyzed for the COPCs that were carried forward from the first iteration of sampling. After data validation, a working "data assessment" meeting will be held with the EPA, TCEQ and Trustees stakeholders ~~and agency stakeholders~~ where the data comparisons are reviewed and decisions are made regarding 1) COPCs that will be carried forward and COPCs that can be eliminated from subsequent iterations of the RI/FS based on whether that COPC originated at the USOR Property; 2) methods and locations for collection of fish and shellfish samples (if necessary) from Vince Bayou (and Little Vince Bayou, if needed) for the third iteration of the RI/FS; 3) other sampling and analytical considerations, etc. A WRN with the agreed-upon recommendations for the next iteration of sampling will be prepared for EPA approval. Upon receiving EPA approval, the specific activities proposed in the WRN will be initiated.
3	Prior to sampling fish and shellfish, sediment and surface water will be evaluated to determine what COPCs should be included in the fish/shellfish sampling program per recommendations and procedures identified in TCEQ, 2002, which is largely based on EPA procedures for evaluating potential impacts from the fish ingestion pathway when establishing surface water quality standards. Fish and shellfish will be sampled and analyzed for the COPCs that were carried forward from the second iteration of sampling. After data validation, the sample concentrations will be compared to the screening criteria for that medium to be developed in the RI/FS Work Plan or subsequently. A working "data assessment" meeting will be held with the EPA, TCEQ and Trustees ~~agency~~ stakeholders where the data comparisons are reviewed and decisions are made regarding the need for subsequent sampling for any media.

Given that the number of samples, the locations of the samples, and analytes to be measured in the samples for the off-property sediment, surface water, and biota cannot be determined until after the on-property media and off-property soil and groundwater data are evaluated, locations for off-property sediment, surface water and biota sampling activities that are described in the following sections and presented on the attached maps are subject to change. Detailed descriptions of the RI data collection activities will initially be provided in the RI/FS Work Plan, the Field Sampling Plan (FSP) and the QAPP as specified in the SOW. These plans will include descriptions of data collection activities for all iterations of the RI/FS. In other words, even though a particular media will not be sampled in the first iteration of the RI/FS (e.g., off-property sediment), the proposed methods for collection of those particular media samples will be included in the RI/FS Work Plan. The specific locations, analytes, and other specific information required for data collection in iterations two and three will be provided in the WRNs.

A comprehensive soil, sediment, and surface water background study (and biota if necessary) will be conducted to provide information related to whether a ~~compound~~ COPC originated at the USOR Property. Detailed information related to this study will be provided in the RI/FS Work Plan after additional research of the surrounding area and discussion with EPA, ~~and~~ TCEQ and Trustees stakeholders on appropriate background reference areas.

Additional information that becomes available before or during the RI/FS will be considered and the investigation plan updated, as appropriate (e.g., the addition of sampling locations at the location of a

previously unknown release). Also, field observations made during the field investigation will be used to guide additional investigation efforts and/or sampling, as appropriate.

General Investigation Activities

As shown in the General Data Needs section of Table 1, general investigation activities will be conducted and are related to the 1) potential presence of threatened and endangered species in the USOR Property vicinity; 2) subsurface utilities present at the USOR Property and off-property areas; 3) erosion potential of soils; 4) climate; 5) zoning and land use; 6) location of the flood plain; 7) historic USOR Property ownership activities, deed records, restrictive covenants, or deed notices; and 8) presence of ecological habitat. In addition, a water well records search will be conducted to identify registered water wells located within ½-mile of the USOR Property. A walking survey of immediately adjacent properties will also be conducted to identify the potential presence of un-registered water wells.

Analytical Methods and Analytes

The historic USOR Property ownership, information about past releases and operations at the property, previous environmental sampling conducted to-date at the property, and waste sampling conducted during emergency response activities indicate that various metals, petroleum hydrocarbons, pesticides and herbicides, several VOCs and SVOCs have potentially impacted AOI-1. Based on the COPCs described above, samples for the first iteration of data collection will be analyzed using the methods listed in the following table:

COPC	ANALYTICAL METHOD	ANALYTES
VOCs	USEPA Method 8260B	Target Compound List (TCL)
SVOCs	USEPA Method 8270C	TCL
Metals	USEPA Methods 6010B/7471A	Toxic Analyte List (TAL)[1]
Pesticides	USEPA Method 8081	TCL
Herbicides	USEPA Method 8151A	Per SW 846 Method
TPH	TX 1005	Per TX 1005 Method

~~Per discussion with EPA and TCEQ, an evaluation of PCBs and dioxins as potential COPCs related to USOR Property operations including sampling of waste containers is currently underway and will be provided to EPA and TCEQ upon completion. Depending on the findings of this evaluation, PCBs and/or dioxins may be added to the COPC list.~~ **PARAGRAPH DELETED PENDING EPA AND TCEQ REVIEW OF REPORT ON WASTE ANALYSIS FOR PCBs AND DIOXINS**

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The COPCs for off-property sediment, surface water and biota will be developed based on the results from the previous iterations of the investigation and whether the COPC was shown to originate at the USOR property. Sample collection techniques, analytical method details, and other analyses that will be conducted on selected samples (e.g., total organic carbon, total dissolved solids, bulk density, grain size, etc.) will be described in detail in the FSP and QAPP to be submitted with the RI/FS Work Plan.

AOI-1 On-Property and Off-Property Soil Investigation

The AOI-1 on-property soil investigation will be performed as described in the following paragraphs:

Soil Borings

[1] Aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.

Proposed soil boring locations are shown on Figure 6. The locations of soil borings are based on review of historic documents, historic aerial photographs, and AOI-1 reconnaissance observations. More specifically, the locations coincide with one or more of the following:

1) Locations of past industrial activities (e.g., railroad spur, loading/unloading pads, former tanks, pipelines, etc.)
2) Locations of current industrial activities (roll-off boxes, bioreactor, etc.)
3) Areas of stressed vegetation;
4) Areas of disturbed soil (as suggested by historical aerial photographs and reconnaissance observations);
5) Locations of historical releases including those described in the HRS documentation and as summarized in Attachment D-1 to this Scope of Work;
6) Previous soil boring location indicating potential contamination;
7) Historic areas of stockpiled material based on aerial photographs; and
8) Areas that appear to receive drainage from USOR Property source areas.

Some of the off-property soil sample locations correspond to historic potential source areas (e.g., the bioreactor release location to the north of the USOR Property), areas of disturbed soil, or areas of stockpiled material. These locations and rationale for soil sample location are discussed in greater detail in Attachment D-1. Preliminary locations shown on Figure 6 are subject to revision based on the data and information collected during the investigation.

All soil borings will be advanced to the top of the uppermost water-bearing unit (anticipated to be approximately 10-15 feet below ground surface) for characterization of surface and subsurface soil and the collection of soil samples. Discrete soil samples will be collected for laboratory analysis of the initial list of COPCs (VOCs, SVOCs, metals, pesticides, herbicides, and TPH). Samples will be collected from the following intervals:

- Surface (0.0-0.5 ft. bgs);
- Shallow (0.5-5.0 ft. bgs) - actual sample interval will be selected from the 0.5-5.0 bgs interval based upon field conditions including visual evidence of contamination, organic vapor meter (OVM) measurements, etc. or from 4.0-5.0 bgs if no evidence of contamination is observed.
- Subsurface (greater than 5.0 ft.) – actual sample interval will be selected from the greater than 5.0 interval based upon field conditions including visual evidence of contamination, OVM measurements, etc. or from the one-foot interval above the saturated zone if no evidence of contamination is observed.

The specific sample intervals will depend on the location and purpose of the particular sample. At locations based on the presence of a current or historic source area or evidence of industrial activity (shown in red on Figure 6), samples will be collected from all three sample intervals listed above. At sample locations along drainage pathways (shown in blue on Figure 6), samples will be collected from the upper two intervals (surface soil, shallow soil).

Selected representative soil samples will be analyzed for potential fate and transport parameters (total organic carbon, bulk density, etc.). A detailed description of the program for soil sample analysis will be presented in the RI/FS Work Plan, the FSP, and the QAPP.

Given the characteristics of AOI-1 (i.e., unconsolidated sediments, shallow depth to groundwater, etc.), it is anticipated that soil sampling will be conducted using direct-push technology (DPT) (i.e., geoprobe).

During the soil investigation, an evaluation of AOI-1 characteristics (e.g., presence and quality of vegetative cover, soil type, etc.) will be performed to qualitatively evaluate the potential for erosion of soils.

The soil boring and the Groundwater High Resolution Site Characterization (HRSC) (EPA, 2003) program (see below) will be conducted prior to the investigations of the other on-property and off-property media. Data and observations from the soil sampling program may be used to revise the subsequent media investigations described in the following section. For example, if field observations during soil sampling activities indicate the presence of non-aqueous phase liquids (NAPL) at AOI-1, the locations and/or quantity of monitoring wells and/or the methods for well construction may be altered. Additional discussion of this issue and detailed procedures for the on-property and off-property sampling program will be presented in the RI/FS Work Plan, the FSP, and the QAPP.

AOI-1 On-Property and Off-Property Groundwater Investigation

As shown on Table 1, the AOI-1on-property and off-property groundwater investigation will be performed as described in the following paragraphs.

High-Resolution Site Characterization

Concepts of the HRSC will be incorporated into the on-property groundwater investigation, as appropriate based on AOI-1 conditions. Initially, a series of vertical subsurface profiles using cone penetrometer testing (CPT) and/or the rapid optical screening tool (ROST) will be conducted perpendicular to the direction of groundwater flow (presumed to be to the northeast toward Vince Bayou, based on previous investigations at AOI-1) (Figure 6). These profiles will allow for the collection of a large amount of subsurface data in a short period of time. The CPT/ROST locations will be advanced to the base of the uppermost water bearing unit. Although limited information is available on the subsurface stratigraphy, it is likely that the uppermost groundwater bearing unit is no deeper than 30 feet below ground surface. The maximum depth of the CPT/ROST investigations will be 50 feet. At most of the transect locations, only the CPT tool will be advanced to provide stratigraphic information (i.e., soil type – sand, silt, or clay). At locations in the central part of the USOR Property around the warehouse, the CPT and ROST tool will be advanced. The ROST tool provides information on soil type and the potential presence of NAPL in soils. If evidence of significant contamination is observed at any location (e.g., the presence of NAPL), advancement of the CPT/ROST tool will be halted. If evidence of significant contamination is not observed, the CPT/ROST boring will continue until the base of the uppermost groundwater bearing unit.

The CPT/ROST borings will be ground-truthed using DPT soil borings. After review of the CPT/ROST data, DPT borings will be conducted at a subset of the CPT/ROST boring locations. For the DPT borings, soil will be collected for visual inspection for the entire length of the boring. Furthermore, the CPT/ROST borings will be completed prior to the on-property soil investigation described above. Information from the CPT/ROST borings may be used to revise the locations, sampling intervals, etc. for the on-property soil borings. Use of CPT/ROST is not currently proposed for the off-property groundwater investigation but could be added based on the CPT/ROST results from the on-property groundwater investigation.

Additional HRSC techniques will be evaluated as the investigation proceeds. For instance, the collection of depth-discrete groundwater samples using multi-level sampling tools may be proposed if distinct multiple groundwater bearing units are observed, or if the groundwater-bearing units are of significant thickness.

Information from the HRSC techniques, in conjunction with information from the monitoring wells (stratigraphy, water levels, etc.) will allow for assessment of the potential hydrogeologic connection between USOR Property groundwater and Vince Bayou.

Detailed procedures for the groundwater HRSC program will be provided in the RI/FS Work Plan, FSP, and QAPP.

Monitoring Well Installation and Groundwater Sampling

The on-property soil sampling and groundwater HRSC programs will be used to determine the locations for permanent groundwater monitoring wells to be installed in the uppermost groundwater bearing unit at AOI-1 (Figure 6). If possible, soil borings will be converted to permanent monitoring wells at the locations where soil boring and monitoring well locations are co-located (Figure 6).

After development, samples will be collected from the monitoring wells and analyzed for the initial list of COPCs. Samples from selected monitoring wells will be analyzed for general or natural attenuation parameters such as cations/anions, total dissolved solids (TDS), etc. Groundwater field parameters (temperature, specific conductance, pH, dissolved oxygen (DO), oxidation-reduction potential (ORP), etc.) will be measured during sample collection at all monitoring wells. Samples will be collected for total and dissolved concentrations of selected metals.

Groundwater sampling events will be conducted to assess seasonal variability (e.g., sample quarterly for a year, evaluate results, and then determine appropriate monitoring program frequency).

All wells will be surveyed by a professional land surveyor to determine spatial (X-Y) coordinates and the elevation above mean sea level of the top of the monitoring well casing (Z).

At a minimum, a water-level measurement will be recorded from each well prior to it being sampled. Separate water-level measurement events not associated with groundwater sampling may also be conducted. If NAPL is encountered, an in-well NAPL thickness measurement will be performed.

The results of the on-property groundwater investigation will be used to 1) determine the need for the investigation of deeper groundwater at AOI-1; and 2) guide off-property groundwater investigation activities. If necessary, these investigations will be conducted during the off-property soil investigation (i.e., the second iteration of investigation).

Detailed procedures for groundwater monitoring well installation and sampling will be provided in the RI/FS Work Plan, FSP, and QAPP.

Hydraulic Testing

Hydraulic testing (slug testing) will be conducted in selected wells to estimate the hydraulic conductivity of the groundwater bearing unit(s). These data will be used to establish groundwater classification (in conjunction with TDS concentrations), estimate groundwater flow velocities, contaminant transport, etc. Detailed procedures for hydraulic testing will be provided in the RI/FS Work Plan, FSP, and QAPP.

AOI-1 On-Property Sediment Investigation

Samples of sediment and will be collected from the two areas at the southwest portion of the USOR Property as noted on Figure 6. The samples will be analyzed for COPCs and other parameters such as TOC, grain size, etc. Sample collection methods will be described in the RI/FS Work Plan, FSP and QAPP.

AOI-1 On-Property Surface Water Investigation

Samples of surface water will be collected from the two areas at the southwest portion of AOI-1as noted on Figure 6 (if present). The samples will be analyzed for COPCs. For the metals, analysis will be conducted for total and/or dissolved concentrations depending on the specific COPC (and as designated

by the ecological benchmark table). Collection of samples from these areas depends on conditions during the investigation since these areas likely do not always contain standing water. Sample collection methods will be described in the RI/FS Work Plan.

AOI-1 Off-Property Surface Water and Sediment Investigation

A program for the evaluation of COPCs from USOR Property-related activities in Vince Bayou (and possibly Little Vince Bayou) surface water and sediment will be developed in a WRN. As shown on Table 1, information on the watershed flow paths, surface water/sediment hydrodynamics, and other potential sources of COPCs to Vince Bayou and Little Vince Bayou will be reviewed during the development of this program. Surface water and sediment samples in Vince Bayou and Little Vince Bayou will be collected, as required, for analysis of COPCs retained from earlier iterations of the RI/FS.

USOR Property Fish/Shellfish Investigation

Sampling of fish, shellfish or other biota in Vince Bayou (and Little Vince Bayou) may be conducted if the results of previous RI/FS data collection iterations show that USOR Property-related COPCs are present in surface water and/or sediment at concentrations above screening levels or if bio-accumulative COPCs are present above applicable thresholds. A WRN will be developed that describes the appropriate species for sampling, the methods for sampling, the COPCs to be analyzed, etc.

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TABLES

FIGURES

ATTACHMENT D-1

AREA OF INVESTIGATION 1
PROPERTY HISTORY AND SAMPLING RATIONALE